History and Utilization of Rosa damascena
Author(s): Mark P. Widrlechner
Source: *Economic Botany*, Vol. 35, No. 1 (Jan. - Mar., 1981), pp. 42-58
Published by: Springer on behalf of New York Botanical Garden Press
Stable URL: http://www.jstor.org/stable/4254246
Accessed: 24/08/2013 23:55

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at
http://www.jstor.org/page/info/about/policies/terms.jsp

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

New York Botanical Garden Press and *Springer* are collaborating with JSTOR to digitize, preserve and extend access to *Economic Botany*.

http://www.jstor.org

History and Utilization of *Rosa damascena*[1]

MARK P. WIDRLECHNER[2]

This report traces the historical literature on the development of the damask rose industry. It begins with a sadly sparse fossil and archaeologic record and continues to the present. The perfection of methods for the production of attar and rose water from Rosa damascena *is reviewed, as are cultural practices and current research programs.*

The various arguments to explain the evolution of Rosa damascena *are presented along with accessory information needed to evaluate them critically. Evidence is presented to support the theory that* R. damascena *was originally an eastern Mediterranean hybrid between* R. gallica *and* R. phoenicia.

It is unfortunate that so few botanists have been willing to study this domesticate, as too many horticulturists have been concerned only with cultivation and higher yields. Most of the current literature on this species is either inaccessible, because of language or general unavailability, or of a popular nature and therefore difficult to evaluate. It is hoped that this review will encourage more research on industrial roses and aid those who wish to search the literature. May it also suggest to crop evolutionists that much work remains to be done on the subject of the domestication of ornamental and medicinal plants.

The cultivation of roses for many purposes has been widespread in temperate climates throughout the world. They are best known for their beauty as cut flowers and as garden ornamentals, but roses have agronomic uses as well. Many volumes have been written about garden roses, but the roses used for food and industrial products have been less widely described in the scientific literature. This report examines one of those roses, the damask rose, *Rosa damascena* Miller.

For the perfume industry, *Rosa damascena* is the most important species for the production of attar of rose, made by distilling volatile oils from the flowers. It is also used widely in the manufacture of rose water, a flavoring agent. The culture of this rose and the manufacture of these products form a significant segment of the agricultural economies of Bulgaria and Turkey and are locally important in other parts of the Middle East and eastern Mediterranean region.

Topics reviewed herein, in relation to the economic development of *R. damascena,* include: the history and future potential of rose products, theories about domestication and evolution, cultural practices, and current research programs.

The records of the eastern Mediterranean region are most closely examined, as that region is the center of production and also a postulated center of origin for this rose. Thirty-one species of *Rosa* are found wild in Turkey; and Mandenova (1970) described Anatolia as a major center of rose differentiation. Most attempts at establishing large scale attar production outside of the region have not met with great success, which does not seem to agree with the generalization

[1] Received 27 June 1980; accepted for publication 4 September 1980.

[2] Department of Horticultural Science and Landscape Architecture, University of Minnesota, St. Paul, MN 55108.

Economic Botany, 35(1), 1981, pp. 42–58
© 1981, by the New York Botanical Garden, Bronx, NY 10458

that plant domesticates usually perform better away from their ancestral lands (Jennings and Cock, 1977).

On one level the generalization does apply, because today's main production centers in Bulgaria and Turkey are removed from the species actual center of origin. *Rosa damascena* was intentionally introduced into Bulgaria in historic times, creating geographic isolation from the center of origin. Three hundred years later, it was then reintroduced into Turkey, creating a temporal separation allowing for selection and new adaptations.

On a more global scale, however, the generalization does not apply, for one finds that the specialization and intensity of labor required to cultivate it successfully and, more importantly, to harvest and process the flowers are rarely found in areas not presently involved in the manufacture of perfume from plant materials.

HISTORY OF ROSES AND ROSE PRODUCTS

Prehistoric and archaeologic

The oldest fossil roses are described from the Paleocene (Hollick, 1936). *Rosa* is a genus which dispersed widely in the Oligocene and began a process of diversification that continues today; but it is impossible to correlate fossil roses to present-day species by solely using vegetative characteristics, and unfortunately the fossil record is quite deficient in floral remains and even fruits are rarities. The lack of well-differentiated fossil leaf types caused Becker (1963) to identify all rose remains as a single species, *Rosa hilliae* Lesq.

Little archaeologic evidence of roses has been found. Casparie et al. (1977) discussed the finding of rose seeds at an inhabited site of the early Neolithic (ca. 5,000 B.P.) near Swifterbant in the central Netherlands. They suggested that humans were intentionally collecting rose fruits for food along with other fruits and nuts including *Corylus, Pyrus, Crataegus,* and *Rubus*. Masses of rose seeds have also been described from Swiss sites (ca. 3,500 B.P.) and in Britain (Renfrew, 1973).

The oldest known tangible historic evidence for the existence and possible use of roses comes to us from the Minoan civilization. The evidence is in the form of remains of a fresco from the palace at Knossos, Crete (ca. 3,700 B.P.). Sir Arthur Evans (1901) first described it in his work, *The Palace of Minos,* and named it the Blue Bird fresco. One rose drawing is preserved in the fragments. The identity of the flower was confused, as Sir Arthur described it as a "golden rose color." Modern reproductions often incorrectly show the flowers to be yellowish (Shepherd, 1954). R. Hurst (1967) saw the original in the Heraklion Museum and noted that the flowers were pink. C. C. Hurst (1941) believed that the rose bore a "striking resemblance to the Holy Rose of Abyssinia, Egypt, and Asia Minor," which he identified as a natural hybrid of *Rosa phoenicia* Boiss. and *Rosa gallica* L. These 2 species have ranges that overlap in the eastern Mediterranean region. The hybrid, also known as *Rosa* × *Richardii* Rehd., is similar to *R. damascena,* the major rose for attar production in the region, and may be of the same genetic stock, but it has fewer petals and a dwarf habit (Rehder, 1940). As for the hybrid's spread, C. C. Hurst (1941) theorized how it may have been introduced into Ethiopia, where it is today grown beside churches, by the proselyting of St. Frumentius of Phoenicia (ca. 300 A.D.).

Remains of *R.* × *Richardii* were also found by Flinders Petrie (Newberry, 1889) in the cemetery of Hawara, in the Fayum province of Lower Egypt, dating from the age of Christ. The fine condition of these remains was most amazing. The flowers were picked in bud and made into a wreath; they dried without disturbing a stamen.

Roses are also pictured in the murals of Pompeii. Floriculture had become well developed by that time (ca. 50 A.D.), and many of the flowers are depicted there in conjunction with the flower industry (Jashemski, 1963). Jashemski did not go so far as to identify the kind of roses pictured. Unfortunately, the figures in the article do not have the clarity necessary for one to make specific identifications.

Early literature

The oldest possible written record of roses would be expected to occur in the Assyrian cuneiform tablets (ca. 4,200 B.P.). However, the Assyrian word for rose has not been adequately defined. Thompson (1949) thought *kasî ŠAR* to be the word, after consulting Assyrian medical tablets and comparison with other ancient pharmacopoeias. Landsberger and Gurney (1958) reexamined such definitions in their *Practical Vocabulary of Assur.* Their interpretations of its uses led them to believe that *kasî ŠAR* was probably *Sinapis nigra* (=*Brassica nigra* L.). The only thing *Brassica* has in common with *Rosa* is its wide variety of medicinal uses. However, that crucifer has no thorns and *kasî ŠAR* was supposed to be a thorny plant. The matter deserves further consideration.

By the time of Herodotus (ca. 500 B.C.), the rose was commonly mentioned in literary works. In Herodotus' *Histories* (VIII-138), King Midas grew many-petalled roses of the finest scent in his gardens of Phrygia, now west central Turkey. The oldest horticultural literature extant on roses is that written by Theophrastus (ca. 300 B.C.). *Enquiry into Plants* is his major surviving work, and in it he described the different types of roses in the eastern Mediterranean region. At that time, well-differentiated cultivars were being grown, including plants with more than 20 petals per flower. In Sections VI, vi. 4–6, he discussed their cultivation: "the plant comes slowly from seed, they make cuttings of the stem . . . if the bush is burnt or cut over, it bears better flowers; for, if left to itself, it grows too luxuriantly and makes too much wood." This procedure would remain rather constant for 4 centuries, for Varro gave these instructions for propagation—"take a plant which has already struck root, and cut the stem, beginning at the root, into slips a palm-breadth long, then cover with earth and transplant them when they too have made a living root."

Theophrastus also related other important information; he distinguished wild roses (*kynosbaton* = dogrose) from cultivated types (*rhodon*). And in *Concerning Odours,* Sections 14–47, he wrote of the manufacture and properties of perfumes. He stated that "sesame-oil . . . receives rose-perfume better than other oils." A similar enfleurage of roses with sesame seeds and the expression of their oils is used today in the manufacture of Gulroghan Hair-Oil in India (Pal, 1966). Also great quantitites of salt were added to the perfumed oil to prevent decay, as explained in the *Greek Herbal of Dioscorides* (I,53). The product was dyed red, possibly with alkanet, *Alkanna tinctoria* (L.) Tausch. (Grieve, 1931), and recommended for use by men (see *Concerning Odours,* Section 42).

There has been much discussion about the many-petalled roses of the Greeks and their contemporaries. They were described as *rosa centifolia* by Pliny; and it was formerly believed that this *rosa centifolia* was the species *Rosa centifolia* L., the old cabbage rose (Bastock and Riley, footnote in Pliny, 1855; Anonymous, 1895). However, the cabbage rose does not appear in European art until the 1600s in Holland (Thomas, 1955). C. C. Hurst (1941) believed the cabbage rose to be of hybrid origin, developed in Western Europe by the fledgling floral industry of the late Middle Ages. Darlington (1973) thought it was bred in Holland in the seventeenth century. It has qualities of 4 species: *Rosa gallica, R. phoenicia, R. moschata* Herrm., and *R. canina* L. *Rosa centifolia* also is not very fertile; some cultivars have been found to be triploid (3n = 21), suggesting a complex hybrid origin.

What then was this many-petalled rose of the ancients? Krüssmann (1977) believed that it was a double form of *R. gallica* as did C. C. Hurst (1941). Shepherd (1954) expressed scepticism of Hurst's arguments about the recent origin of *R. centifolia*: "It seems incredible that a rose as distinctive as *R. centifolia* should suddenly appear in Holland and in Southern France, in such large quantities as to cause it to be considered native . . . . The possibility the *R. centifolia* is a hybrid of very ancient origin cannot be discounted entirely with the present evidence so obviously incomplete." Shepherd (1954) reported that plants similar to *R. centifolia* had been found in the Caucasus by von Bieberstein, but the species is not listed as occurring in the wild in either the *Flora of the USSR* (Komarov, 1940) or *Flora of Turkey* (Nilsson, 1972).

The Romans continued the literary tradition of the rose established by the Greeks. Billiard (1928) gave a brief summary of the literature, but did not supply much interpretation. Pliny gave the most comprehensive description of roses presently extant from that age (ca. 50 A.D.). In Book XXI, Chapter 10, of *Natural History,* he described 12 varieties, naming them by locality. It is impossible to assign species names to these 12, as the descriptions are not detailed enough. He had developed a taxonomic system in which, "The essential points of difference in the rose are the number of petals, the comparative number of thorns on the stem, the color, and the smell." The cultivars were so developed that there existed one known as *Graecula* that never fully opened. Pliny described the plants' propagation and also correlated the soil and climate with the perfume produced.

Pliny commented upon the subject of pharmacognosy. He listed 32 remedies derived from roses (Book XXI, Chapter 73). He wrote of the astringent and laxative properties of the petals. In Spain their use for such effects is still common. Speaking of the glories of rose petals, Font Quer (1973) went far in stating, "Ansí que me resuelvo a decir que es la más saludable y católica medicina de cuantas Dios crió para el uso de los mortales." (And thus I resolve to say that it is the most wholesome and comprehensive medicine for human use from all that God grows. (author's translation))

Pliny was also the first to give us a recipe for the concoction of rose wine, where rose leaves are added to grape must in the ratio of 40 drachms for every 20 sextarii. This product was then aged for at least 3 mo. Perhaps the Romans chose a rose with fragrant leaves such as *R. rubinigosa* L. (Gordon, 1953; Staykov, 1971).

Columella, a contemporary of Pliny, made mention of roses in his agricultural work, *De Re Rustica,* but only of their planting, care, and the sale of their flowers, which he learned from experience as a gentleman farmer or from Varro's treatise *On Farming*. Thus his encouraging description for potential rose merchants, "Et titubante gradu multo madefactus Iaccho, Aere sinus gerulus plenos gravis urbe reportet" (Chapter X, 305–310). (Thoroughly soaked with wine and with staggering steps, the carrier returns from the city, bringing back a filled purse heavy with coins. (author's translation)).

The rose industry was quite advanced in Rome at the time of Pliny; roses decorated houses, and were occasionally strewn through the streets. The Romans had a festival, Rosalia, to celebrate and honor the rose. The extravagant use of roses seemed boundless. Suetonius, in *Nero* (Chapter 27), told the story of a banquet given to Nero where the roses alone cost more than four million sesterces, more than $100,000! But the translation of this passage has been questioned (Anonymous, 1895). Perhaps that section described the gift of rose plantations, by defining *rosaria* in a broader sense.

Martialis, in *Epigrams*, vi. 80, xiii. 27, wrote, "The rose was once the flower of Spring; now she is wholly Caesar's flower." This lament is indicative of the increasing commercialization and marketing of roses to the patricians, and it makes one wonder how they were supplied with such quantities of Caesar's flower. Egypt was one of the suppliers. Roses were unknown in that country prior to 631 B.C. (Krüssmann, 1977), but were grown there in increasing quantities after 300 B.C. Theophrastus, in *Enquiry into Plants*, Section VI, viii. 5, described how roses flowered 2 mo earlier in Egypt than in Greece. This earliness gave incentive to commerce, to supply Romans with the first roses of the year. But Roman rose-lovers were not to be outdone; forcing techniques were well known (Pliny, Book XXI, Chapter 10).

One of the centers of Roman rose production was the Campanian plain, noted for its remontant, or reblooming, roses. The only remontant rose in Europe until the Middle Ages was *R.* × *bifera* (Poiret) Pers., the autumn damask rose (C. C. Hurst, 1941). It is considered to be a hybrid between *R. gallica* and *R. moschata*. The first literary reference to remontant roses occurs in the tenth century B.C., on the island of Samos, but Hurst's theory must be viewed with some caution as the present range of *R. moschata* lies far to the east. For more on remontant roses and floriculture on the Campanian plain, consult Jashemski (1963) and Billiard (1928).

The ancients employed the processes of enfleurage and maceration to obtain their perfumed oils (Naves and Mazuyer, 1947), but what of rose water and the precious attar?

Rose water and attar

The discovery of rose water is not recorded in history; the first reference to it is found after its production was already an established industry. Ibn Khaldum stated that the province of Faristan, in Iran, was required to give a tribute of 30,000 bottles of rose water annually to the Caliph at Bagdad for the years 810–817 A.D. (Perry, 1925). Istakhri described the export of rose water from Faristan to China and throughout the Islamic world. The first European reference to rose

water is in *Le Calendrier d'Harib* (for 961 A.D.) (Sawer, 1894), which recommended that rose water and other rose products be prepared in April. In the tenth century A.D., the Moors probably brought the technology for rose water production to Spain along with their territorial expansion.

The distillation of the attar from rose water came later and probably arose independently in Europe and the Arab world. Wecker, in 1574, named Geronimo Rossi of Ravenna as the first to accomplish it (Flückinger, 1867). Flückinger also showed that the attar, *Oleum rosarum destillatum,* appeared in the price lists of German apothecaries of the 1600s.

In India a more romantic tale of the origin of attar is told. Manucci (ca. 1680), citing Mohammed Achem's history of the Grand Moguls from 1525–1667, *Tarykh monekheb lubab,* described the feast of the seventh year of the reign of Djihan-Guyr, where "The princess (Nour-Djihan) indulged her luxurious caprice so far as to have a canal circulating round the garden filled with rose water. Whilst the emperor was walking with her along the banks of this canal, they perceived a kind of scum floating on the surface of the water, and realized that it was something from the roses which the heat of the sun had caused to separate from the water (through evaporation) and to aggregate in a small mass. Everybody agreed that it possessed the most delicate perfume known in India." The feast took place in 1612, and the distillation in Persia dated from the same year.

Spread of production and usage

Attar quickly became popular and by the end of the 1600s the distilleries at Shiraz, Iran, were a major industry. The cultivation of roses for attar spread to the east and west from Persia, as is evidenced by the fact that the word *attar* is borrowed from the Turks; and in Farsi, *aettr* originally meant fat (Orozoff, 1906). The related Hindi word *itr* describes a product made by absorbing rose flower distillate in oil of sandalwood (Pal, 1966). In modern Turkish, the attar is known as *gul yagi*; *gul* is also from Farsi, where it means flower but is often applied to the rose. The Russians, Ukranians, Romanians, and Bulgarians have all adopted the Turkic attar in various forms, showing how the industry has spread. Other Indo-European languages, with the exception of English, use their own word meaning oil or essence.

The rose that was grown most often for attar production has been *R. damascena,* the damask rose, or some similar species. The evolution and phytogeography of the damask rose is discussed in the third section of this paper. As for linguistic evidence of this rose's spread, the appellation, damask, refers to Damascus, although that name can only be traced back to the Crusades. Compte de Brie has been credited with bringing roses to France from the east around 1270 (Shepherd, 1954). But Shepherd also stated that the first writing of *rosa damascene* was not until the 1500s. The Spanish also knew this rose as *la Rosa de Alejandria* (Mas-Guindal and Mas-Guindal, 1944), perhaps dating back to the Moorish occupation.

At the close of the seventeenth century, a Turkish merchant introduced rose culture into the province of Eastern Roumelia (now part of Bulgaria) (Orozoff, 1906), and began the largest rose plantations in the world, growing *R. damascena*

along with the more cold tolerant *R.* × *alba* L., which gives a lower quality attar (Guenther, 1952; Igolen, 1966).

In India, roses were grown commercially in Uttar Pradesh, which remains the center of Indian attar production. The variety 'Bussorah' or 'Barwana' of *R. damascena* is the most important (Pal, 1966).

The introduction of *R. damascena* to Israel was not without impact on the local economy. Gilad (1975) wrote, "The growing of Damask roses in Israel created a revolution in gardening, and the Damask rose quickly conquered the first place of all roses which were praised in the times of the 'Mishna' (Middle Ages)." Jericho and Jerusalem were centers of cultivation, and a full range of rose extracts were produced. The beauty of the Jericho roses was extolled by Felix Fabri in 1480. By the 1800s the fields had gone wild and production declined. Baron E. de Rothschild tried to reestablish a modern rose oil industry in the late 1800s, but manufacturing difficulties and pathogens halted production in 1905, and it has not resumed (Gilad, 1975). In more recent times, the culture of roses in Israel has expanded greatly. A variety of cultivars are being grown for cut flowers to supply a growing export market.

A singular mystery in the distribution of *R. damascena* involves Turkey. In the 1600s and 1700s, Turks and Arabs were spreading the rose industry throughout their domains, but for 200 yr the record in Turkey is silent. *Rosa damascena* was introduced *into* Turkey in 1894, by a Bulgarian emigrant from Kazanlik (Bredemann, 1917). Rose culture became established in Burdur and Isparta, which continue as the primary districts of Turkish production.

Bursa, a vilayet of northern Turkey, also grew a few native roses called *Hafis*, that produced many small, dark red flowers on thornless stems, but the oil was of an inferior quality and the Turkish government worked to eradicate it to discourage its use as an adulterant (Igolen, 1966). This rose was probably a type of *R. gallica,* as none of the other native roses that would grow wild at Bursa has dark red flowers (Nilsson, 1972).

During the Middle Ages, the Islamic world was first enjoying vast quantities of rose water and later small, but increasing, amounts of attar. When Saladin retook Jerusalem from the Christians in 1187, he would not enter the Mosque of Omar, which had been used as a church, until it was purified by rose water. The rose water required the use of 500 camels for its transport from Damascus. Mohamet II demanded the same purification for the Mosque of St. Sophia, after his conquest of Constantinople in 1453 (Gordon, 1953).

Rose water also became a favorite flavoring material for desserts and beverages, which it remains today; for a good collection of recipes consult Smith (1973) and Gordon (1968). The Bulgarian government now makes a carbonated beverage, *Etur,* flavored with the essence of rose and other fruits (Komitet po Kachestova Standartizatsiyata i Metrologiyata, 1972). Rose flavoring is also popular in the confection, *rakhat-lukum* (Chechelashvili and Korinteli, 1971) and in preserves (Vurkhoven Suvet po Standartizatsiya, 1970).

The attar, because of its concentrated fragrance and prohibitive cost (up to $5,000/kg for Bulgarian attar in 1980 (Darnton, 1980)), has been used almost exclusively in the manufacture of expensive perfumes. For other purposes, volatile solvent extracts or inexpensive synthetic substitutes are available (Guenther, 1952).

CULTIVATION PRACTICES AND PRODUCTION

Culture

In Bulgaria roses are planted together to form long hedges, which grow to 2 m. They are propagated by division of the crown. The divisions are planted in fall and 2 yr later are productive, with maximum production at about the fifth year (Orozoff, 1906). The largest hectarage is found in the Strema and Toundja river valleys, north of the Sredna-Gora range. *Rosa* × *alba*, a later introduction used to demark the borders of the fields, and *R. damascena* live "in harmonious Yorkist-Lancastrian co-existence," as Gardiner (1970) stated.

The fields are pruned in March before new growth appears. And the lanes between the shrubs are cleared in spring and fall. In the Bulgarian valleys, rainfall is adequate year round making irrigation unnecessary (Sawer, 1894).

The Turkish plantations are started by making trenches 40 cm deep by 40 cm broad and 1.5 m apart. The propagules are placed in the trenches, spaced about 50 cm apart. In 2 yr the plants should grow to a height of at least 1.5 m. The plantation can last 30 yr with yields of 3,500–5,000 kg of flowers per ha, twice the yields of *R. centifolia* in Grasse, France (Garnero et al., 1976).

Burdur and Isparta, the Turkish production centers (approx. 1,350 ha under cultivation), have sufficient moisture and are partially forested, thus supplying the wood needed for peasant attar stills (see next section) (Igolen, 1966). In Isparta, the plants are watered in the autumn to supplement rainfall. Most of the growers fertilize with sheep manure. Although ammonium sulfate and superphosphate are recommended, they are too costly.

Pathogens and other pests that damage rose plantations are much the same throughout Europe and western Asia. Garnero et al. (1976) listed them along with the pesticides commonly used. The pathogens include the fungi, *Phragmidium subcorticium* (Schrank) Wint. and *Uncinula necator* (Schw.) Burr. (which is surprising since *Sphaerotheca* spp. and not *Uncinula* spp. usually are the most common powdery mildews on *Rosa* (U.S.D.A., 1960)), and insects include the aphid, *Macrosiphum rosae*, and especially *Agrilus aurichalceus*, a beetle with larvae that can deform rose stems. In May 1974, *Agrilus* larvae destroyed whole fields in Turkey (Garnero et al., 1976).

Processing

Until recent times the processing of the flowers was done in small scale operations. The "peasant processing" varied greatly. When spring comes to the rose fields, they quickly become pink seas and the rose pickers must work quickly. The harvesting period is short and dependent upon the whims of nature. In a cool, cloudy spring, it may last for a month, while in hot seasons, for only 16–20 days (Orozoff, 1906; Perry, 1925).

Each day before dawn the workers go to the field and collect freshly opened blossoms. The collection stops when the sun dries the dew on the flowers. The oil yield is significantly lower if the flowers are picked after 0900 hours (Igolen, 1966).

The flowers are brought to stills (made variously of copper or iron sheet metal) and mixed with water. The distillate is then collected in metal tubing cooled by water. The primary distillate is usually redistilled, and various distillates mixed

to obtain the desired properties (Garnero et al., 1976); in Kashmir multiple distillations were common (Tschirch, 1917). The attar is skimmed from the surface of the combined distillates, the remainder of which is used as rose water. The wood required to fuel the stills to manufacture 1 kg of essential oil (attar) is about 2,000 kg; and the ensuing deforestation creates grave erosion problems and competes with the use of wood as a home fuel.

The residue of processed petals is then compressed and dried. Bulgarian researchers have been experimenting with ways to obtain essence from these residues by chemical and microbiological methods (Kupenov et al., 1971).

The industrialization of these processes was begun, first by standardization and expansion of the peasants' equipment, but then by new large scale factories. The first volatile solvent treatment factory was built by Charles Garnier in 1904 at Kara Sarli, Bulgaria. After World War I, 6 more factories were built, 3 of which were still operating in 1939 (Naves and Mazuyer, 1947). Both steam stills and volatile solvent extraction systems are used commercially in Bulgaria (Guenther, 1952). Solvent extraction is more commonly used for *R. centifolia* in France and north Africa, because its flowers are not adapted to water distillation.

The Turks started large scale processing in 1926 with the construction of a factory in Isparta with 6 stills with a combined capacity of 4,000 l (Igolen, 1966). Both the static and, more modern, rotary extraction units were installed in the region in the 1950s. Better testing and an increase in the percentage of industrially-produced attar have improved the export outlook of Turkish attar since 1965 (see below).

In Bulgaria the government collectivized the rose farms after World War II. In 1945, it also centralized and nationalized the distilleries, creating a national production and marketing enterprise, Bulgarska-rosa (Guenther, 1952). The old copper stills are used no more and Bulgaria remains a world leader in the production of the attar of the damask rose (Gardiner, 1970).

Output and exports

The first modern export records available are for exports from the Ottoman Empire, to England and France for 1860 (Farley, 1862). At that time, the Empire included Bulgaria; and a total of 1,110 kg of attar was exported.

The next Turkish figures are from the newly founded industry for 1913. Ravndal (1926) stated that 273 kg of attar were produced. No mention was made of export figures. In more recent times, Turkish production has increased markedly, although Turkey suffers the burden of producing rose extracts that are considered by much of the perfume industry to be somewhat less desirable than those from Bulgaria due to less stringent production controls (Igolen, 1966). In the period 1962–1965, about 1,200 kg of attar were exported annually (Garnero et al., 1976), and for 1970–1973 about 2,800 kg. The 1973 export value was about $1,405,000 (13 TL = U.S.$1), and this made up about ½ of 1% of total Turkish export value (Devlet Istatistik Enstitüsü, 1974). Rose water is also exported: in 1972 over 6,000 kg, but it is much less valuable. Persia used to export great quantities of rose water to India, over 200,000 kg in 1891 (Tschirch, 1917).

Orozoff (1905) listed Bulgarian attar production of 2,142 kg in 1899, 4,076 kg in 1903, and 4,197 kg in 1904. His figures by weight for exports, in those same

years, were higher than production. Either large scale storage of attar, unaccounted for production, or adulteration may make up the difference.

World War II had an impact on Bulgarian rose production. In 1939, 6,300 ha were devoted to rose culture; whereas in 1948, this declined to 2,000 ha (Rochlin, 1957). Since the War, culture has expanded somewhat; a more detailed description may be found in a report by Topalov and Irintchev (1967). Levels of export for attar, the product of steam distillation, and the concrete, resulting from volatile solvent extraction, continued to decline in the 1950s. Only 523 kg of attar were exported in 1960, but this rose to 1,831 kg in 1968, nearly equaling Turkey's exports (Bulgaria-Tsentralno Statistichesko Upravlenie, 1969). In 1971 exports were 1,298 kg of attar and 1,385 kg of the less valuable concrete (Bulgaria-Tsentralno Statistichesko Upravlenie, 1972). The principal destinations of these products were the USSR, France, and the United States.

CURRENT RESEARCH

Research programs dealing with *R. damascena* have expanded greatly in recent years. In Bulgaria, the Research Institute for Oil-Bearing Roses, Aromatic, and Medicinal Cultures at Kazanlik has worked to improve the local cultivar 'Kazanlik.' This rose has variable clones, which are being examined for selection (Astadjov, 1975a). The selection 'Iskra' (Astadjov, 1975b) has been released. It surpasses average yields, measured in terms of the weight of blossoms per hectare, by over 90%.

Milewski leads a long-term rose breeding program in Poland and has used *R. damascena* as a parent for the creation of a multipurpose cultivar 'Memory of Wiesław Milewski' (*R. damascena* × *R. rugosa* Thunb.). This cultivar is ornamental, has good fruit production, and also has flowers which can be used in confectioneries (Milewski, 1975). Milewski and Mrożewski (1958) discussed, in more detail, the use of rose petals in the confection and baking industry.

A breeding and testing program has been in progress since 1962 in the Soviet Union. The selection 'Crimean Red' has been grown along the Black Sea since 1926, when Gunko selected it at the Nikitshii Botanical Garden (Nazerenko, 1974). This may be a *R. damascena* or perhaps *R. gallica*. Two of the best new cultivars are 'Michurin' and 'Festival.' Their oil yields were about twice as great as 'Kazanlik' and 'Crimean Red' for a 9-yr test conducted by the All Union Scientific Research Institute. The cultivar 'Michurin,' a hybrid between 'Kazanlik' and 'Crimean Red,' was found to be high yielding in Moldavia and the Krasnodar border region. It is similar in appearance to 'Kazanlik,' but is shorter, and the flowers have more petals on the average (Nazerenko, 1974; Astadjov, 1975a). 'Festival' is also a hybrid of the same parentage. It grows 1.5–2 m tall and has redder flowers than 'Kazanlik.' Nazerenko was enthusiastic about the impact of these new hybrids: "The wide introduction of high yielding varieties permits great enhancement of rose oil production, for all production zones of this valuable aromatic oil." (author's translation)

The future of *R. damascena* and other plants grown for labor intensive perfume production does not merely rely on plant breeding programs, although breeding and research are definitely important to the survival of the industry. Two of the most vulnerable links in attar production are labor and competition. Large

amounts of semiskilled labor must be available for a few weeks of the spring. During the rest of the year, the area may not be able to support such a labor force. As for competition, synthetic chemicals are increasingly important to the perfume industry. High prices for attar encourage substitution and efforts to increase natural oil production may not be enough to overcome this trend and expand output.

With regard to expanding production in other parts of the world, training field and laboratory workers would be a major obstacle as would land availability. *Rosa damascena* requires land that would normally be used to produce food crops. Although the rate of monetary return might be higher in the long run from a rose plantation, the combination of taking land out of food production and delayed return from capital investment would discourage expansion into many otherwise suitable parts of the globe.

EVOLUTION OF *ROSA DAMASCENA*

Taxonomy and genetics

Two questions must be posed about *R. damascena* to make any discussion of its evolution useful. How is *R. damascena* different from other rose species? And, how does the work of humans fit into its development?

The first question is not a simple taxonomic query. The characters of many roses are noted for their intergradation. This has continually plagued the student of *Rosa*. One of the first rose taxonomists, Lindley (1820), went so far as to say that "our knowledge of European Roses has become, by the extraordinary attention they have received, so extensive that it is impossible to doubt that limits between what are called species do not exist." Through the diligent work of Crépin and Boulenger, a system of classifying Old World roses emerged. But there were still subjects that the rose taxonomist would not care to handle. Boulenger (1936) warned about *R. gallica*, a probable parent of *R. damascena* (of which he made no mention in any of his extensive studies), "Elle a produit beaucoup d'hybrides, qu'il est parfois très difficile de distinguer des formes pures." (It (*R. gallica*) has produced so many hybrids that it is sometimes very difficult to distinguish pure forms. (author's translation))

Most botanists agree that *Rosa damascena* belongs to the section *Rosa* (*Gallicanae*). This section contains the polymorphic species, *R. gallica*, found in both wild and cultivated forms, and a number of species that are likely either forms of *R. gallica* or hybrids between *R. gallica* and species of other sections. One must then ask how *R. damascena* differs from *R. gallica*. *Rosa damascena* is taller and more robust; the prickles are all nearly the same size; the inflorescences are usually many-flowered; and the fruit is oblong, not globose (Komarov, 1940; Willmott, 1912; Rehder, 1940). Willmott and Rehder stated that the leaves of *R. damascena* are glabrous, but Thomas (1955) disagreed, saying "all of the distinct Damasks do have a soft pubescence on the upper surface of their leaves." Shepherd (1954) discussed *R. damascena*'s special propensity for recurrent flowering, and used this character as a basis for his evolutionary theory. Another distinguishing character is the noted airborne fragrance of *R. damascena* blossoms. The fragrance of *R. gallica* is not so dispersed (Thomas, 1964).

The cytogenetics of the section *Rosa* have been extensively studied. Most

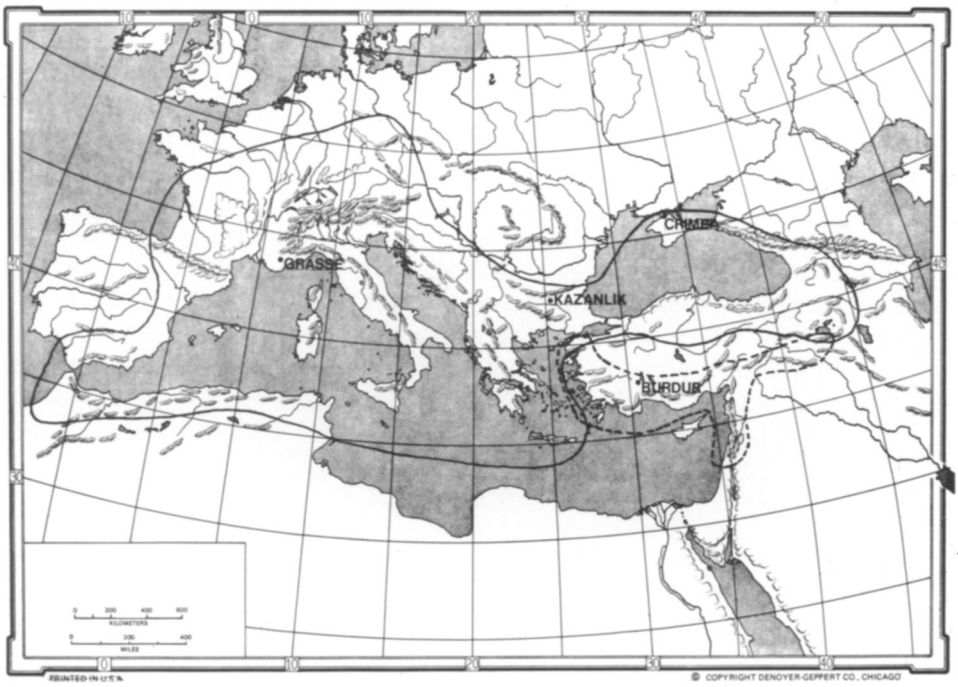


Fig. 1. Solid line = range of *Rosa gallica* L.; broken line = range of *Rosa phoenicia* Boiss.; dots = centers of attar production. Map © Denoyer-Geppert Co., used by permission.

cultivars are tetraploid with 28 chromosomes (Darlington and Wylie, 1955), but a few interesting exceptions have been noted. Suzuka (1953) found a diploid *R. damascena* and occasionally a triploid *R. centifolia* is found (C. C. Hurst, 1941). And the damask cultivar 'Omar Khayyam,' which was grown from seed sent from Naishapur, Iran, to Kew Gardens, was found to be pentaploid (2n = 35, ♀ = 21 and ♂ = 14).

Rosa damascena is usually propagated vegetatively; since the time of Theophrastus, one has been advised against growing roses from seeds. Shepherd (1954) noted that the seedlings from self-pollinations of *R. damascena* show great variability. Thus one might assume a hybrid origin. Crépin (1879) was the first to do so. He believed that *R. damascena* was an ancient cross between *R. gallica* and *R. canina* L. However, due to the unusual pentaploid genetic system of the section *Caninae* (Rowley, 1967; Darlington, 1973), *R.* × *alba* had been identified as a hybrid between section *Rosa* and *R. canina* (C. C. Hurst, 1941). *Rosa canina* is pentaploid (2n = 35, ♀ = 28 and ♂ = 7), and it would be difficult to describe a system for the recovery of a 28 chromosome hybrid, unless 2 sets of chromosomes were lost. Since Crépin, most authors have agreed that *R. gallica* was one of the parents of *R. damascena*. However, Naves and Mazuyer (1947) proposed that *R. gallica* was derived from a cross between *R. damascena* brought to France from the east and a local variety. The wide distribution of *R. gallica* (Fig. 1) makes this theory highly unlikely, but it is possible that some genetic exchange took place if *R. damascena* was introduced into French rose culture.

C. C. Hurst (1941) presented an alternative to Crépin's explanation: "It is

evident therefore that the Damask Roses are all hybrids of *rubra* (=*gallica*) but that some are hybrids of *phoenicia* while others are hybrids of *moschata*." The *R. moschata* × *R. gallica* plants, he identified as *R.* × *bifera*, the autumn damask rose with remontant flowering. The other combination he thought to be the progenitor of *R. damascena*. *Rosa moschata* and *R. phoenicia* are both in section *Synstylae*; *R. phoenicia* is found wild around the eastern Mediterranean (Fig. 1) and *R. moschata* is native to Afghanistan, the Himalayas, and China (Boulenger, 1933). Thomas (1955) commented, "It always strikes me as strange that some hybrids inclining more towards *Rosa moschata* have not been found." Thomas also stated that the *Synstylae* are known to add fragrance to hybrids.

The lack of continuous intergradation may not be so strange after all since the present wild ranges of *R. gallica* and *R. moschata* do not overlap and since *R. damascena* has been grown for centuries within the range of *R. gallica*. In Turkey and the Balkans, much more crossing could take place with *R. gallica* and the genetic material originating with *R. moschata* would be diluted, except when intentionally selected.

The *Synstylae* are diploid and one might expect a triploid hybrid (perhaps sterile) or a fertile hexaploid as the result of crossing with a tetraploid like *R. gallica*. But this is not the case. The crossing of diploid and tetraploid roses has often led to tetraploid cultivars of importance and wide variety (Darlington, 1973; Wylie, 1954).

Before World War II, there had been considerable debate on the nature of polyploidy in *Rosa*. Täckholm (1922) and Boulenger (1936) felt that the first roses were of high ploidy, octaploids or decaploids, and that more advanced roses had a tendency to lose chromosome sets. If one relates this theory to the similar tetraploids of the section *Rosa*, one could have them all arise by reduction of a common ancestor of higher ploidy. Erlanson (1938) disputed this, saying, "this hypothesis is contrary to the established cytological principle that polyploidy is a secondary and derived condition." Her argument included the 3 related primitive diploid genera, *Hesperhodos*, *Platyrhodon*, and *Hulthemia*, which some consider to be subgenera of *Rosa*, and cytogenetic and phytogeographic evidence that has put the matter to rest.

Phytogeography and human selection

How does human interference fit into an evolutionary scheme for *Rosa damascena?* This species has not been collected in the wild. Boissier (1872) was the first to note that it was not found spontaneously in Asia, and more recent florae concur (Hegi, 1923; Komarov, 1940; Nilsson, 1972). But the techniques of rose culture were well established by the rise of Ancient Greece, and roses were highly prized. If a chance hybrid possessing the scent and the aesthetic qualities of *R. damascena* were then found, the plant could have been perpetuated. Theophrastus, in *Enquiry into Plants*, Section VI, vi. 4, wrote of the Philippians who transplanted the many-petalled roses that they found growing on Mount Pangeus. If rose clones spread by human hands, we could expect a variety of hybrids between the introduced types and local wild species.

But there is the more basic question of the initial factors that influenced the domestication of all roses. As opposed to many other crop domestications, the

forces of uniformity do not win over individuality. As with corn in Mexico (Wilkes, 1970), roses have been chosen for their variety and special qualities; and only vegetative reproduction can act as the barrier to diversity caused by outbreeding and a general lack of genetic barriers to recombination.

If roses were initially selected for their fruit, the effects are not now apparent. Rose fruits have not been mentioned in any detail by the ancients as a food source, although locally they may have been of importance. If roses were chosen for their medicinal qualities, one might expect to find rose cultivars with special medicinal attributes; but excepting the rose of Provins, *R. gallica* f. *officinalis,* and the attar producing cultivars, that is not the case. Of course many medicinal plants have not been used on a scale which would encourage their domestication. Although many medicinal plants have been cultivated, most have been collected from the wild and continue to be so gathered (Isaac, 1970).

However, if roses were chosen for aesthetic qualities, especially flower form and color, and secondarily for lack of thorniness, then the plants so cultivated and selected would soon not be able to survive as wild things. Fewer thorns could decrease the rose's protection from grazing animals. And the choice of double flowers might decrease fertility, as could the choice of heterotic interspecific hybrids.

After a society is established enough to provide its basic needs, decorative materials assume importance. Through the example of the lotus in Ancient Egypt (Joret, 1894), one can see how a plant can truly provide decorative inspiration. (For a different perspective on possible reasons for the use of the lotus motif in Egyptian art, consult Emboden (1978).) Even if few depictions of roses are found in the archaeologic record of a region, one cannot eliminate the possibility that archaeologists may just be searching in the wrong places, for the rose is too beautiful to be wasted.

It is probable that *Rosa damascena* resulted from the interaction between conscious selection and the opportunity for the movement and recombination of many roses in the eastern Mediterranean region. In the above section on taxonomy and genetics, various theories about the origin of *R. damascena* were presented. C. C. Hurst (1941) outlined a theory most in accord with the weight of the evidence. *Rosa gallica* and *R. phoenicia* have overlapping ranges in the coastal regions of Turkey (Fig. 1) (Boulenger, 1932, 1933, 1936; Post, 1932; Nilsson, 1972; Komarov, 1940; Mas-Guindal and Mas-Guindal, 1944; Josifović, 1972). The 2 species there are allopatric (Nilsson, 1972), but human intervention or other chance events could overcome edaphic barriers. *Rosa gallica* is extremely polymorphic (Boulenger, 1936), and it has already been implicated in the parentage of a hybrid similar to *R. damascena, R.* × *Richardii* (Rehder, 1940). It is possible that by crossing the range of *R. gallica* types to *R. phoenicia,* progeny similar to *R. damascena* could be recovered. Of course that would be no final proof, only evidence, because the original parents of the plants which gave rise to *R. damascena* are long lost to the vagaries of time.

Perhaps chemotaxonomic research could lend greater insight into the parentage of *R. damascena.* Its essential oils are well characterized (Garnero et al., 1976; Naves and Mazuyer, 1947; Tschirch, 1917). For a comprehensive bibliography of works describing these chemical components, read the report of Garnero (1976). The chemical technology has reached a point where only a single blossom

is needed for determining the oil composition (Balinova-Tsvetkova et al., 1974). Even if most concern so far has been for yield and quality of product, the same techniques could be used to analyze the oils of rose flowers as a chemotaxonomic and possible phylogenetic tool. The use of compounds, such as those occuring in attar, for such a purpose has been attempted with varying degrees of success in *Salvia* (Emboden and Lewis, 1967), *Ambrosia* (Payne et al., 1972), and *Cupressus* (Zavarin et al., 1971).

ACKNOWLEDGMENTS

I wish to thank S. Dragula, R. Hummel, C. Robacker, K. Robertson, and D. Williams for editorial assistance, and A. Jelinek, E. Logue, J. Mosher, I. Widrlechner, and S. Wittmer for help with translations. Their gracious gifts notwithstanding, I assume responsibility for any errors in this report.

LITERATURE CITED

Anonymous. 1895. Review of *The Book of the Rose* and *The Rose-Garden*. Quart. Rev. 182: 110–125.

Astadjov, N. S. 1975a. Studies on the clones from the population of Kazanlik Rose (*Rosa damascena* Miller). Rivista Italiana Essenza, Profumi, Piante Officinali, Olii Vegetali, Saponi 57: 623–626.

———. 1975b. A new variety of the Kazanlik oil-bearing rose, Iskra. Rasteniev. Nauki 12: 59–63.

Balinova-Tsevtkova, Y. M., and R. Atanassova. 1974. A method for determination of rose oil composition in a single flower of the Kazanlik rose. Dokl. Sel'skokhoz. Akad. Sofia 7: 45–48.

Becker, H. F. 1963. The fossil record of the genus *Rosa*. Bull. Torrey Bot. Club 90: 99–110.

Billiard, R. 1928. L'Agriculture dans l'antiquité d'après les Géorgiques de Vergile. pp. 518–520. E. de Boccard, Paris.

Boissier, E. 1872. Flora Orientalis. Vol. ii. H. George, Geneva.

Boulenger, G. A. 1932. Les roses d'Europe de l'Herbier Crépin. Bull. Jard. Bot. État 12: 193–209.

———. 1933. Revision des roses d'Asie de la section des Synstylae. Bull. Jard. Bot. État 9: 211–229.

———. 1936. Revision des roses d'Asie. Bull. Jard. Bot. État 14: 115–169.

Bredemann, G. 1917. The otto of rose industry in Asiatic Turkey. Bericht Schimmel Apr–Oct: 45.

Bulgaria-Tsentralno Statistichesko Upravlenie. 1969. Vunshna na turgoviia: Narodna Republika Bulgaria Statisticheski Danni 1939–1968. Sophia.

———. 1972. Vunshna na turgoviia: Narodna Republika Bulgaria Statisticheski Danni 1939–1971. Sophia.

Casparie, W. A., B. Mook-Kamps, R. M. Palfenier-Vegter, P. C. Struijk, and W. van Zeist. 1977. The paleobotany of Swifterbant. Helenium 17: 28–55.

Chechelashvili, E. V., and I. N. Korinteli. 1971. Specification of recipes and waste standards for rakhat-lukhum manufacturing. Trudy Gruzinskii Nauchno-Issledovatel'skii Institut Pishchevoi Promyshlennosti 4: 321–326.

Columella, L. J. M. Ca. 50 A.D. De Re Rustica. Translated by H. Boyd, 1941. Harvard Univ. Press, Cambridge, MA.

Crépin, F. 1879. Primitiae monographiae rosarum. Materiaux pour servir à l'histoire des roses. Bull. Bot. Soc. Belg. 18: 221–416.

Darlington, C. D. 1973. Chromosome Botany and the Origin of Cultivated Plants. 3rd ed. pp. 196–205. Hafner, New York.

———, and A. P. Wylie. 1955. Chromosome Atlas of Flowering Plants. pp. 134–139. George Allen & Unwin, London.

Darnton, J. 1980. Bulgaria's rare rose oil for perfumes may be rarer after a bad winter. New York Times. 26 June 1980, p. A10.

Devlet Istatistik Enstitüsü. 1974. Aylik diş ticaret istatistikleri. Turkey Monthly Foreign Trade Statistics.

Dioscorides. Ca. 50 A.D. The Greek Herbal of Dioscorides. Translated by J. Goodyer, 1655. R. T. Gunther, ed., 1933. Hafner, New York.

Emboden, W. A. 1978. The sacred narcotic lily of the Nile: *Nymphaea caerulea*. Econ. Bot. 32: 395–407.

——, and H. Lewis. 1967. Terpenes as taxonomic characters in *Salvia* section Audibertia. Brittonia 19: 152–160.

Erlanson, E. W. 1938. Phylogeny and polyploidy in *Rosa*. New Phytol. 37: 72–81.

Evans, A. J. 1901. The palace of Minos. Monthly Rev. 2: 115–132.

Farley, J. L. 1862. The Resources of Turkey. p. 47. Longman, Green, Longman & Roberts, London.

Flückinger, F. A. 1867. Documente zur Geschichte der Pharmacie. Halle.

Font Quer, P. 1973. Plantas medicinales el Dioscorides renovado. Editorial Labor, Barcelona.

Gardiner, L. 1970. Roses of Bulgaria. Contemp. Rev. 211: 101–104.

Garnero, J. 1976. Sur la composition des huiles essentielles et absolues de rose bulgare (*Rosa damascena* Mill.). Revue de la littérature. Revista Italiana Essenza, Profumi, Piante Officinali, Olii Vegetali, Saponi 58: 548–552.

———, G. Guichard, and P. Buil. 1976. L'huile essentielle et la concrete de rose de Turquie. Rivista Italiana Essenza, Profumi, Piante Officinali, Olii Vegetali, Saponi 58: 160–179.

Gilad, D. E. 1975. Roses in Israel. Amer. Rose Annual 60: 10–17.

Gordon, J. 1953. Pageant of the Rose. Studio Publ., New York.

———. 1968. The Art of Cooking with Roses. Noonday Press, New York.

Grieve, M. 1931. A Modern Herbal. Hafner, New York. 3rd printing with new index, 1967.

Guenther, E. 1952. The Essential Oils. Vol. V., pp. 3–38. Van Nostrand, New York.

Hegi, G. 1923. Illustrierte Flora von Mittel-Europa. Vol. 4. J. F. Lehmann, Munich.

Herodotus. Ca. 500 B.C. The history of Herodotus. Translated by G. Rawlinson, 1930. J. M. Dent, London.

Hollick, A. A. 1936. The tertiary flora of Alaska. U.S. Geol. Surv. Profess. Paper #182.

Hurst, C. C. 1941. Notes on the origin and evolution of our garden roses. I. Ancient garden roses (2000 B.C. to A.D. 1800). J. Roy. Hort. Soc. 66: 73–82.

Hurst, R. 1967. The Minoan roses. Rose Annual 59–65.

Ibn Khaldum. Ca. 1400 A.D. The Muqaddimah; an Introduction to History. Translated by F. Rosenthal, 1967. Princeton Univ. Press, Princeton, NJ.

Igolen, G. 1966. The turkish rose. Soaps, Perfumery & Cosmetics 39: 461–471.

Isaac, E. 1970. Geography of Domestication. p. 114. Prentice-Hall, Englewood Cliffs, NJ.

Istakhri. 1754. Das Buch der Länder. Ed. Mordmann, Hamburg.

Jashemski, W. F. 1963. The flower industry at Pompeii. Archaeol. 16: 112–121.

Jennings, P. R., and J. H. Cock. 1977. Centres of origin of crops and their productivity. Econ. Bot. 31: 51–54.

Joret, C. 1894. Les Jardins dans l'ancienne Égypte. Imp. Marchessou Fils, Le Puy.

Josifović, M. 1972. Flora of Serbia. Vol. 4, pp. 54–55. Beograd.

Komarov, V. L. 1940. Flora of the USSR. Vol. 10, pp. 322–363. Israel Program for Scientific Translations, Jerusalem.

Komitet po Kachestucta Standartizatsiyata i Metrologiyata. 1972. Bulgarian Standard BDS 9375-72. Sophia.

Krüssmann, G. 1977. The rose in art and history. Rose Annual 67–77.

Kupenov, L. G., E. V. Georgiev, G. P. Ganchev, and P. G. Boyadziev. 1971. Dokl. Bulg. Akad. Nauk 24: 1345.

Landsberger, B., and O. R. Gurney. 1958. Practical vocabulary of Assur. Archiv für Orientforschung 18: 328–341.

Lindley, J. 1820. Rosarum Monographia; or, a Botanical History of Roses. J. Ridgeway, London.

Mandenova, I. P. 1970. A revision of *Rosa* in Turkey. Notes Roy. Bot. Gard. Edinburgh 30: 327–340.

Manucci, N. Ca. 1680. History of the Mogul Dynasty in India. Translated by F. Catrou, 1826. J. M. Richardson, London.

Martialis, M. V. Ca. 100 A.D. Epigrams. Translated by W. Ker, 1919. Heinemann, London.

Mas-Guindal, J., and A. Mas-Guindal. 1944. Plantas Productoras de Esencias, Resinas y sus Derivados. Seccion de Publicaciones, Prensa y Propaganda, Madrid.

Milewski, J. 1975. New varieties of fruit roses. Nowe odmiany róż owocowych. Sylwan 119: 61–68.

———, and S. Mrożewski. 1958. Płatki kwiatów róży surovcem aromatychnosmakowym w przemyśle spożywczym. Przemysl Spożywczy #10/11/12.

Naves, Y. R., and G. Mazuyer. 1947. Natural Perfume Materials. Translated by E. Sagarin. Reinhold, New York.

Nazerenko, L. G. 1974. The best kinds of aromatic rose. Luchshie sorta rozi efirnomaslichnoi. Vsesoiuzn. Nauchno-Issl. Inst. Efirnomaslichnykh 7: 14–16.

Newberry, P. E. 1889. On the vegetable remains discovered in the cemetery at Hawara. *In* W. M. Flinders Petrie. Hawara, Biahmu, and Arsinoe. pp. 46–53. Field & Tuer, London.

Nilsson, Ö. 1972. *Rosa*. *In* P. H. Davis, ed. Flora of Turkey and the Aegean Islands, Vol. 4. pp. 106–128. Univ. Press, Edinburgh.

Orozoff, P. I. 1906. The Rose—Its History. P. I. Orozoff et fils, Kazanlik, Bulgaria.

Pal, B. P. 1966. The Rose in India. pp. 179–182. Indian Council Agric. Research, New Delhi.

Payne, W. W., R. W. Scora, and J. Kumamoto. 1972. The volatile oils of *Ambrosia* (Compositae: Ambrosieae). Brittonia 24: 189–198.

Perry, E. J. 1925. Perry's Cyclopaedia of Perfumery. J. & A. Churchill, London. Vol. 2, pp. 630–664.

Pliny. Ca. 50 A.D. Natural History. Translated by J. Bastock and H. T. Riley, 1855. Henry G. Bohn, London.

Post, G. E. 1932. Flora of Syria, Palestine and Sinai. 2nd ed. J. E. Dinsmore, ed. Vol. 1, pp. 458–461. American Press, Beirut.

Ravndal, G. B. 1926. Turkey: a commercial and industrial handbook. U.S. Dept. Commerce, Trade Promotion Series #28. Govt. Printing Office, Washington, DC.

Rehder, A. 1940. A Manual of Cultivated Trees and Shrubs Hardy in North America. 2nd ed. pp. 426–435. Macmillan, New York.

Renfrew, J. M. 1973. Paleoethnobotany. The Prehistoric Food Plants of the Near East and Europe. p. 150. Columbia Univ. Press, New York.

Rochlin, R. P. 1957. Die Wirtschaft Bulgariens seit 1945. Deutsches Institute für Wirtschaftsforschung, Berlin. Sonderhefte #38.

Rowley, G. D. 1967. Chromosome studies and evolution in *Rosa*. Bull. Jard. Bot. Nat. Belg. 37: 45–52.

Sawer, J. C. 1894. Rhodologia. A Discourse on Roses and the Odour of Rose. W. J. Smith, Brighton.

Shepherd, R. E. 1954. History of the Rose. Macmillan, New York.

Smith, L. W. 1973. The Forgotten Art of Flower Cookery. Harper & Row, New York.

Staykov, V. 1971. Some oil-bearing species of the genus *Rosa*. Dokl. Sel'skokhoz. Akad. Sofia 4: 199–201.

Suetonius. Ca. 150 A.D. Nero. *In* The Lives of the Caesars. Book VI. Translated by J. C. Rolfe, 1959. Harvard Univ. Press, Cambridge, MA.

Suzuka, O. 1953. Chromosome numbers in pharmaceutical plants II. Rep. Kihara Inst. Biol. Res. 6: 79.

Täckholm, G. 1922. Zytologische Studien über die Gattung *Rosa*. Acta Horti Berg. 7: 97–381.

Theophrastus. Ca. 300 B.C. Enquiry into Plants, and Concerning Odours. Translated by A. Hort, 1916. Heinemann, London.

Thomas, G. S. 1955. The Old Shrub Roses. Phoenix House, London.

———. 1964. Damask roses. A group of the old shrub roses. Rose Annual 37–41.

Thompson, R. C. 1949. A Dictionary of Assyrian Botany. British Academy, London.

Topalov, V., and I. Irintchev. 1967. Rose Production in Bulgaria. Plovdiv.

Tschirch, A. 1917. Handbuch der Pharmakognosie. Vol. 2, pp. 791–816. Verlag von Chr. H. Tauchnitz, Leipzig.

U.S.D.A. 1960. Index of Plant Diseases in the United States. Agric. Handbook #165, Washington, DC.

Varro, M. T. Ca. 50 B.C. Rerum Rusticarum Libri (On Farming). Translated by L. Storr-Best, 1912. G. Bell & Sons, London.

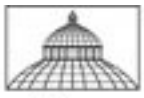
Vurkhoven Suvet po Standartizasiya. 1970. Bulgarian Standard BDS 804-70. Sophia.

Wilkes, H. G. 1970. Teosinte introgression in the maize of the Nobogame Valley. Bot. Mus. Leafl. Harvard Univ. 22: 297–311.

Willmott, E. 1912. The genus *Rosa*, Vol. XIX. John Murray, London. (The rose illustrations are most beautiful.)

Wylie, A. P. 1954. The history of garden roses I. J. Roy. Hort. Soc. 79: 555–571.

Zavarin, E., L. Lawrence, and M. C. Thomas. 1971. Compositional variations of leaf monoterpenes in *Cupressus macrocarpa, C. pygmaea, C. goveniana, C. abramsiana* and *C. sargentii*. Phytochemistry 10: 379–393.



THE NEW YORK BOTANICAL GARDEN

Springer

Roses in the Middle Ages
Author(s): Mia Touw
Source: *Economic Botany*, Vol. 36, No. 1 (Jan. - Mar., 1982), pp. 71-83
Published by: Springer on behalf of New York Botanical Garden Press
Stable URL: http://www.jstor.org/stable/4254352
Accessed: 25/08/2013 00:14

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at
http://www.jstor.org/page/info/about/policies/terms.jsp

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

New York Botanical Garden Press and *Springer* are collaborating with JSTOR to digitize, preserve and extend access to *Economic Botany*.

http://www.jstor.org

Roses in the Middle Ages[1]

MIA TOUW[2]

Though we now tend to consider roses only as subjects for horticulture and perfumery, there were times when their significance extended far beyond that. Their religious symbolism among the Christian Europeans merits a section to itself; and the section on their practical significance in medicine occupies almost half of the present article. Yet it is not because roses were less important in perfumery and horticulture that the latter two are eclipsed in this way, but only because they were so much more important in areas where they are now forgotten.

HISTORICAL BACKGROUND

Roses reached the height of European favor in the 1200s and the 1300s after several centuries of increasing popularity. At first, however, the severe asceticism of some early Christians, notably St. Clement of Alexandria, caused the use of flowers and perfumes generally to be denounced as abhorrent. Roses and lilies were considered special culprits (Gordon, 1953). This was a natural reaction to the significance of roses for their near neighbors and mortal enemies, the Romans. Roses and rose water were a major sign of luxury, and as such were indispensable on occasions of conspicuous consumption. Not only were there whole fountains of rose water, and not only would the floors sometimes be carpeted knee-deep with rose petals, but guests at banquets would have rose petals thrown over them. At a banquet given by Nero this rain of rose petals reached such proportions that several of the noble guests suffocated under the mass of flowers (Krüssmann, 1977).

The Romans learned to love the rose after their contact with the Persians and the Middle East, though they expressed their feelings in their own characteristically extravagant way. Similarly, hundreds of years later, the returning Crusaders would bring back to Europe a heightened appreciation of the rose. An understanding of the rose in the Middle East is necessary to understanding the influences which shaped European use of and thoughts about roses. Always favorites, they had been cultivated in western Asia and northeastern Africa 5,000 yr ago (Lehner and Lehner, 1960). There were roses in the gardens of Semiramis, queen of Assyria (Lehner and Lehner, 1960). The Zoroastrian text *Bundehesh* speaks of both a "hundred-petalled" rose and a "dog" rose, and mentions that the rose acquired thorns only when evil appeared in the world (Joret, 1892), an idea which would be repeated in European stories millenia later.

In a legend common among the Turks and the Persians, roses were said to be born of drops of Mohammed's sweat (Joret, 1892), a story which was both a cause and effect of roses' increasing popularity. There are legends that the rose took the place of the lotus as the queen of flowers in the Near East, an indication

[1] Received 26 August 1980; accepted 28 March 1981.

[2] Arnold Arboretum, Harvard University, 22 Divinity Ave., Cambridge, MA 02138.

Economic Botany, 36(1), 1982, pp. 71–83

© 1982, by the New York Botanical Garden, Bronx, NY 10458

of its importance there after Islam became prevalent (Joret, 1892). In the Near East roses became a symbol of faithfulness and constant affection extending even after death. Numberless poets compared their beloveds to roses. Saadi, a Persian poet, called his famous compilation of moral and religious poems the *Gulistan* or "rose garden," to imply the pleasure and insight they would bring to the reader (Eastwick, 1974). In Moslem countries the flower came to be considered so holy that a mosque desecrated by nonbelievers could only be cleansed by being washed (entirely!) with rose water (Gordon, 1953).

To supply the great demand for roses and their products, an extensive industry developed in Persia which was at its height during the centuries between 900 and 1600 A.D. (Guenther, 1952). Ibn Khaldun, a Persian of the 800s, quotes a tax account showing that Fars had to pay Baghdad 30,000 flasks of rose water (in addition to 27,000,000 dirhams and 20,000 lb of black raisins) to satisfy the taxes (de Slane, 1862). Istakri, his contemporary, reported that the rose water of Fars was the best in the world and was exported as far as Spain and China (Mordmann, 1845).

The rose industry spread from Persia to the surrounding countries, among them Arabia. The Arabs perfected the art of distillation and were therefore able to make new products (Joret, 1892), among them attar of roses, and to produce larger quantities of good quality rose water. Especially the latter (because there was more of it) was extensively traded by the Arabs and was introduced to Christian Europe as early as the second half of the tenth century (Joret, 1892).

The rose products mentioned in various accounts do not always mean the same thing, though they may go by the same name. The rose water of the Romans was made simply by soaking petals in water, but after the invention of distillation it meant the distillate which results when roses are boiled in water. Similarly, early references to rose oil involve oil, usually olive oil, in which rose petals have been soaked a long time (e.g., Hort, 1916). True attar of roses, however, is the essential oil which separates from the distillate; sometimes this too is called rose oil.

The date when this essential oil was first discovered is a subject of debate. In the last century, literary references to attar prior to 1600 had not been found, and therefore it was thought that it had been invented around that time. The reference in question here was Mohammed Achem's account of Sultan Jehangir's wedding, which took place in 1643 (Parry, 1925; Gordon, 1953). The canals in the palace gardens had been filled with rose water for the occasion and his queen noticed a thin, oily and highly aromatic film on the water, which arose "due to the heat of the sun on the roses." She ordered it collected and named it "atr-i-Jehangiri" (Guenther, 1952; Lehner and Lehner, 1960). There is a flaw in this story which indicates that the process of making rose oil by distillation was known to Mohammed Achem and that therefore his account of the queen's "discovery" is more polite than true. The flaw is that heat would not only drive the oil out of the rose petals, but would also keep it in solution in the water; cooling would be necessary to allow the oil to separate out. The oily film could have arisen only at dawn after a cool night preceded by a hot day, but the author does not seem to specify these conditions.

More recent research has unearthed a far older reference to what was probably rose attar in Harib's chronicle of 961 written at Cordova (Guenther, 1952). It

seems likely that the Arabs, who were enthusiastic alchemists—distillation was, to my knowledge, central even to early alchemy—should be the first to discover the oil as a by-product of their researches. That Charlemagne's court received attar from Baghdad (Krüssmann, 1980) is evidence of how quickly the Arabs' discovery became an important article of trade. Avicenna, of the late 900s, is credited by some with being the original discoverer (Thompson, 1927; Gordon, 1953). Other candidates, who also lived somewhat too late to qualify, are Rhazes, who lived between the ninth and tenth century, and Aben-Zohar of Seville (Gordon, 1953). Attar of roses was independently discovered by Geronimo Rossi of Ravenna in 1574. In *De Distillatione Liber,* published in 1582, he reports that he noticed an extremely odorous oil rising to the surface of rose water under the proper conditions (Parry, 1925; Gordon, 1953).

Other rose products which became important in the Middle Ages, though they were usually only used medicinally, were rose honey, rose syrups, and eventually rose sugar. The honey and sugar were prepared simply by mixing in rose petals and allowing them to stand. The syrups would sometimes be boiled with rose petals (Joret, 1892).

It is not always clear, at this distance of time, exactly which roses were being used, either in ancient Rome or in medieval Persia or Europe. According to Parry (1925), Pliny apparently described *Rosa gallica* L., *R. centifolia* L., *R. damascena* Mill., *R. provincialis* [Herrm.] (=*R. gallica* L.), *R. moschata* [Herrm.], and *R. rubiginosa* [L.]. But Krüssman (1977) mentions only *R. gallica* and *R. damascena,* and he furthermore notes that the epithet "hundred-leaved" cannot be assumed to refer to *R. centifolia* L.; he considers it more likely to have been a highly double flowered *R. gallica* (Krüssmann, 1980). Guenther (1952) mentions that *R. damascena* is probably a hybrid between *R. gallica* and *R. canina* L., which would imply that *R. canina* existed in gardens as well in Pliny's time. However, the Caninae are the only section of the rose genus which show heterogamic meiosis; hybridization with one of the Gallicanae is therefore unlikely (Rowley, 1967). Darlington (1963) considers *R. moschata* Herrm. to be the other parent of *R. damascena.*

By the time of Macer Floridus (approximately 1000 A.D.), the species named were reduced to "rosa centifolia" and *R. canina* L. and a "wild rose" (Frisk, 1949). Meyer (1855) records a yet glummer situation in which even the name of the easily identified *R. canina* is misapplied. Quintus Serenus Samonicus mentions a "rosa" and Marcellus Empiricus writes about a "rosa sylvatica" (Meyer, 1855). Around 1100 a popular, so-called gothic, version of Dioscorides' herbal appeared (which was eventualy printed at Colle in 1478). In a chapter which is so highly changed from the original that it is difficult to tell which original chapter it refers to, *R. canina* is mentioned (Fischer, 1929). Dioscorides himself apparently mentioned only "rosa lutea" by name (Gunther, 1959). Fischer (1929) reduces the numerous rose names he found in his extensive review of medieval botanical literature to 6 species: *R. canina* L., *R. arvensis* L., *R. rubiginosa* L., *R. centifolia* L., *R. alba* [L.], and *R. villosa* [L.]. The numerous synonyms he gives for the first 4 species are listed below, partly to show just how numerous they are, partly to help other wanderers in the mazes of medieval German botanical literature.

Rosa canina L.	*R. arvensis* L.	*R. rubiginosa* L.	*R. centifolia* L.
rosa	rosa campestris	bedegar	rosarius
tribulus		rosa bedegar	rosa alba
rosa canina		wichhagenrosen	wyss rosen
zizisa		egelentyerrosen	edel rosen
rosa agrestis			gefullt rosen
rosa sylvestris			zam rosen
antera (anthera)			
cinosbato			
iuiube			
hyffa			
hagen			
hifaldra			
wildirosa			
veltrosen			
buttenrosen			
wichhagenrosen			

By Parkinson's time, around 1600, the number of rose species had reached and surpassed that of the Romans. Parkinson (1629) describes 24 different "species," many of them separated only on the basis of coloration. Some of the species he mentions are: rosa damascena, rosa cinnamomea, rosa moschata, rosa sempervirens, rosa provincialis, rosa sine spinis multiplex, rosa holoserica, rosa pomifera maior, and eglanteria duplex. As one can see, some of the increase in number is caused by excessive splitting of taxa; but on the other hand, some of the increase may be real, greater gardening skill allowing new hybridizations and the introduction of new species from the East or from the wild. Thus "rosa cinnamomea" may be the same as the currently valid species of that name (*R. cinnamomea* L.) yet it is not mentioned in earlier references.

ROSES IN EARLY HORTICULTURE

The cultivation of roses, which had been extensive in Roman times, was neglected for a few centuries after the fall of Rome. The only people with the leisure and sensibility to grow roses were monks and nuns, but that was the time of Christian revulsion against roses and all things Roman (Joret, 1892). Pre-Christian Germanic people planted wild roses near graves and as hedges around holy places (Ranke, 1951), but garden roses were unknown.

The Benedictines were the first to take the concept of gardens, as we know them, across the Alps. In the 700s garden roses were growing in southern France, probably in the form of hedges (Fischer, 1929). The future of rose gardening was assured, however, by Charlemagne's edict of the late 700s which prominently included roses in the plans for Crown land gardens (Krüssmann, 1980). The influence of this plan was very great and caused rose cultivation to spread rapidly (Fischer, 1929). In 840, the garden plan of St. Gallen's monastery showed roses bordering the "Herbarius" together with lilies (Fischer, 1929). The preservation and expansion of these garden varieties was carried on by monastery and convent gardens from whence they spread to castle gardens and gradually to other, humbler, secular gardens.

Though all flowering plants were grown for their practical value, often for medicine, roses and lilies were also grown simply for beauty and to decorate the

altar on certain festivals (Joret, 1892). Around 1200, Albertus Magnus included roses in his plan of the ideal pleasure garden. There would be a perfect lawn with shade trees on the south side, a wall to the west to keep out stormy winds, many flowers, among them roses, on the north side, and a beautiful spring or fountain in the middle (Albertus, 1867). By this time, rose cultivation had spread to Danish convents and monasteries (Joret, 1892). Poets, who had probably travelled and seen Italian rose gardens, have left behind some very early references to garden roses in Germany. However, since they are accompanied in these cases by such exotics as fig trees, one must assume that these references are poetic licence rather than botanical fact (Fischer, 1929).

RELIGIOUS SYMBOLISM OF ROSES

The religious significance which roses gradually acquired probably accounts for their eventual unparalleled popularity. Though we are now better acquainted with the originally Eastern love symbolism of the rose, the pre-Christian Germans associated it with the soul and with death (Ranke, n.d.). The flower was also sacred to Freya, goddess of love (Joret, 1892). In other words, the foundation for its acceptance as a Christian religious symbol was already present. Perhaps this foundation was an important factor in the evolution of the rose's religious significance, because it is a fact that the Bible does not speak of it that way. Moldenke and Moldenke (1952) show that "roses" in the Bible often refer to other beautiful but nonrosaceous flowers. In any case, whenever they are mentioned, only their beauty and decorative value are stressed; they are not spoken of symbolically (nor are they used medicinally).

Rose symbolism goes back to the earliest Christians. The ones to whom it meant worldliness and sensuality, though originally numerous, finally lost to those who saw the rose differently. St. Cyprian, who was martyred in 258, and St. Jerome, who lived around 400, praised roses and named them as one of the rewards that martyrs would find in Heaven (Joret, 1892; Gordon, 1953). Saint Benedict, scarcely a hundred years after St. Jerome, saw in roses only a means of "mortifying his flesh" whenever he felt "the world" drawing him back: a use of roses, or rather of their thorns, which is also reported for St. Francis of Assisi (Gordon, 1953).

As early as the first century, red roses were said to spring from the blood of martyrs (Gordon, 1953), and in 840, Walahfried Strabo wrote that the death of Jesus gave the rose its color. "Roses for war, for peace the lily," said Walahfried (Payne, 1966). To Saint Bernard (1091–1153), the rose not only symbolized the sufferings of Christ, but also Mary, white roses symbolizing her virginity and red ones her compassion (Joret, 1892). (Eve was a thorn in this scheme of things.) Thus, by a slow process, roses came to mean divine love to the Christians, and through symbolizing Christ's sufferings came to symbolize Christ Himself as well.

The miracles in which roses played a part are uncounted. An oft-repeated class of rose miracles involves food being surreptitiously carried to the poor which is changed into roses when the "culprit" is apprehended by hostile observers. The most famous of these was experienced by St. Elizabeth of Hungary. She was the exceedingly charitable queen of Louis, King of Thuringia, who was her childhood sweetheart. While he was away on a crusade, famine swept the country, and on

returning he heard embittered tales from his relatives how Elizabeth had created shortages at the palace by feeding certain of the poor. Louis believed the tales and forbade his wife to continue her charitable deeds. Nonetheless she continued to do so secretly, until one day he caught her with a basket full of food. On uncovering it, however, it proved to contain only perfect white roses which, since it was wintertime, was rightly construed as a miracle. Even her enemies were converted.

Joret, to whom I am indebted for the above account, also records a miracle explaining the origin of the rosary. A young monk, who was not generally hard-working, was unfailing in his devotions to the Virgin Mary. Once he was in a forest when it came time to say his prayers to Her. Unbeknownst to himself he had been surrounded by robbers. Once he started praying, Mary appeared, which caused the robbers to stop and only look on while she took 150 roses from his praying lips and worked them into a garland. The roses shrank as she worked them, and when they resembled beads she placed the garland on the monk's neck and disappeared (as did the robbers, in a more mundane way).

As a tangible expression of divine love, roses were often included in paintings of saints to show the divine love expressed in their lives (Gordon, 1953). There is an old pentecostal custom in Rome, probably going back to the time of Saint Gregory, who was pope between 590—604, of strewing roses down on the congregation from the top of the church to symbolize the coming of the Holy Ghost (Cornides, 1967). The custom spread to France and Spain as well, so that Pentecost is sometimes called "rose Easter" (Joret, 1892). Paradise, as a place replete with divine love, came to be called a rose garden, a theme which the minnesänger helped to popularize (Joret, 1892). The rose symbolism of Christ was also expanded. While red roses signified His sufferings, as before, the kingly yellow color denoted his majesty after the resurrection, the latter being expressed in the fragrance of the flowers (Cornides, 1967).

A golden rose was also used to show papal approbation, no doubt on the grounds that it was the closest earthly equivalent to divine love. The origins of the golden rose ceremony are obscure, but in its mature form it consisted of the bestowal of a rose of gold on the fourth Sunday after Lent by the pope to a person or group conspicuous for loyalty to the Church (Cornides, 1967). The first record of the ceremony is a papal bull of Leo IX in 1049 who required a golden rose or the equivalent weight in gold from the Heiligenkreuz monastery in Alsace-Lorraine. He refers to earlier ceremonies using the golden rose, so he is not the originator of the custom (Cornides, 1967). The first record of the ceremony as such dates from 1096 when Pope Urban II gave a golden rose to the Count of Anjou (Cornides, 1967). The recipients were usually temporally powerful, and quite mundane considerations would influence the choice of the "loyal" recipient.

In his very thorough scholarly work on the subject, Cornides lists 2 possible origins for the ceremony. It may have grown out of a custom, whose very existence is uncertain, commemorating Maria Magdalen's use of costly fragrant oil for Jesus's feet. During that ceremony the pope would give alms of fragrant spices. A further circumstance makes this ceremony a possible ancestor: Cornides does not seem to mention it, but Gordon (1953) tells us that in the earlier form of the ceremony the golden branch carried more than one 5-petalled rose, the topmost one being filled with balsam and musk. On the other hand, "rose

Sunday," as it is sometimes called, shows definite similarities to the orthodox mass centered on the cross given on the same Sunday. Both ceremonies are performed to intimate approaching Easter and to remind the faithful to look beyond fasting and penitence. Lent's penitential purple draperies and vestments are changed to rose color for this one Sunday to indicate the coming splendor of the risen Christ. Cornides favors this origin, which only involves a substitution of the rose for the cross as a symbol of Christ, over the rather obscure Magdalen custom.

Dante made probably the best-known use of the rose as a Christian symbol. Though in the thirtieth canto of *Paradise* the eternal rose is golden, and in the thirty-first it is whiter than snow, the image remains one of the whole of Heaven as an infinite eternal rose, whose petals are souls and whose fragrance is the never-ending praise of God (Sayers and Reynolds, 1964). In using this symbol, Dante seems to have given the highest expression to a rose symbol that was current during the 1200s and 1300s.

The rose as Christ went through one final permutation as a symbol for the Rosicrucians and the alchemists. The crucified rose became the sign of the Rosicrucians, while the alchemists took the metaphor even further and spoke of the resurrection of the rose. "[A]ll material being placed in a glass vessel, with a certain quantity of pure dew, forms a blue powder, from which, when heat is applied, there springs a stem, leaves and flowers, and a whole and perfect plant is formed from its own ashes" (Rosenberg fide Gordon, 1953). The alchemists considered the process of transmuting base metals to gold as an allegory of the soul's passage from worldliness to becoming a Son of God, so it is unlikely that the above quotation was ever meant as more than a metaphor.

THE ROSE IN LOVE, HERALDRY AND MAGIC

The secular symbolism of the rose is not entirely contained in its association with love and beauty. The Germanic peoples had originally associated it with death, the Christians with religious feelings. It was only after contact with the Orient that the rose came to mean worldly love in Europe (Ranke, n.d.), but the relatively late beginning did not stop it from becoming a widespread meaning in a short time. The major medieval love poem was named the Romance of the Rose, not of the violet or the lily. In Chaucer's rendering of it, he describes a beautiful maiden in the garden of love who

> So worthy is beloued to be,
> That well she ought, of prise and right,
> Be cleped Rose of every wight.
>
> (Sutherland, 1967).

The god of love in that garden is, furthermore, crowned with roses (Sutherland, 1967). In ancient Greece, Eros is supposed to have bribed the god of silence with a rose to persuade him to preserve silence on the affairs of the gods. Thus the rose became an emblem of secrecy and would be attached to the ceiling of council chambers to indicate that all present were *sub rosa,* or sworn to secrecy (Lehner and Lehner, 1960). Krüssmann (1977) gives a more mundane origin for this term: Greek army leaders, conferring in a rose bower, planned a surprise attack on

their Persian enemies and the secret plan was concluded "under the rose," which denoted strict confidentiality ever after. The rose as a sculptured ceiling decoration persisted till the last century, though its significance there had been forgotten. Joret (1982) remarks that rose crowns were common at medieval festivities. At marriages, with an intertwining of their religious and secular significance, they denoted both the virginity and the loveliness of the bride. As with the papal golden rose, the rose chaplet will sometimes have been inappropriately bestowed.

The rose had several related meanings in heraldry. When King Edward III founded the Order of the Garter, or the Order of St. George as it is sometimes called, the knights were to wear roses as part of their full regalia on St. George's Day. That day is celebrated even now by wearing roses (Gordon, 1953). After the Wars of the Roses, it became an even more important heraldic flower in England. A rose in full bloom meant mercy and justice. One in full bloom with some of the petals still in bud at the center and surrounded by 5 points to indicate thorns, meant beauty and nobility acquired with difficulty. Of course, the rose's religious meanings secured it a place on the crests and seals of many popes (Gordon, 1953).

Possibly as a remnant of pre-Christian times, possibly because of its association with marytrs, red roses occurred in superstitions as a sign of approaching death, especially sudden death (Joret, 1892). On the other hand, because the blood of Christ was supposed to have touched red roses, witches and devils were thought to fear them (Gordon, 1953).

Roses were not extensively used in magic except as ingredients in love potions. For the latter, Persian women used rose water; colonial United States women made "rose tipple" by marinating rose petals in brandy (Hendrickson, 1974). Tristan and Isolde's love potion is thought to have contained roses (Gordon, 1953). In a work attributed to Albertus Magnus, but probably written by one of his students, the following, less benevolent potion, is recorded: rose seed plus mustard seed plus a weasel's foot, all powdered and put into a bag which was hung in a fruit tree, would stop the tree from bearing fruit (Best and Brightman, 1973). Burying beetles in roses would kill them (Best and Brightman, 1973).

PRACTICAL USES OF THE ROSE

Rose cosmetics suffered from the same break in tradition as did the other uses of the rose. Dioscorides left behind a rose pomander recipe consisting of 40 drams of fresh roses beginning to fade and before "they have taken any wet," 10 drams of Indian nard, and 6 drams of myrrh. These were to be "beaten small," made into little balls and dried in the shade. "The use of it is to be put about women's necks instead of necklaces, dulling the unsavourie smell of the sweat" (Gunther, 1959). It may be interesting to note that this process survives to our day. Linsley (1977) described a method of making a necklace which would retain fragrance for many years, by repeatedly grinding rose petals (in a meat grinder in this case) and then forming the mass into little balls and drying it. Galen used a full pound of rose oil in a cosmetic which was the ancestor of modern cold creams (Hendrickson, 1974).

After the fall of Rome, rose cosmetics languished until rose water was introduced by the returning Crusaders. Bathing in rose water became a thing to do,

and rose water finger bowls appeared at the meals of those with any pretensions to gentility (Joret, 1892). The importance of these finger bowls can only be grasped when one considers that forks were not known in England until the reign of James I, and were then considered a "great piece of foppery" (Rimmel, 1865). Even refinements like cleaning the mouth with rose water after meals arose (Joret, 1892).

The greatest practical importance of the rose was in medicine. According to Krüssmann (1980) it was *R. gallica* and *R. canina* that were the medicinal species. Generally speaking, the rose was used to allay fever, inflammation or pain, or to stop any kind of excessive flow, be it lachrymation or diarrhea or a hemorrhage. These effects were deduced from the cool and dry properties ascribed to the rose by the authorities of the Middle Ages, such as Dioscorides, Galen and Avicenna. Dioscorides said that rose flowers cool and bind (i.e., stop flow), but that those which are dried bind more. Sprinkled on the gums, they stopped bleeding; made into a tea, they stopped diarrhea and the spitting of blood. Pounded fresh rose leaves made eye salves, while wine in which rose leaves had been soaked was applied as a wash for headaches and for troubles of the eyes, ears, gums, as well as of the rectum and vulva. Inflammations, including erysipelas and wounds, were treated with rose wine compresses (Gunther, 1959).

Theophrastus (Hort, 1916) gives an interesting clue to the possible reason why roses are considered to help ear pain. The Greeks used salt in the manufacture of rose perfume and by being warm and dry—or as we would say, somewhat antiseptic—it reduced the inflammation. Possibly this was also the source of the unresolved confusion about whether roses were "warm" or "cool." In the *Hortus Sanitatis* (Meydenbach, 1511), for instance, we find both properties listed without any attempt to reconcile the contradiction. The pattern is repeated in many herbals, though the stress is always on the cooling qualities.

Galen's *Littiere ad Corisium,* whose substance must have originally been written in Greek, was translated from the Arabic to the Catalonian by Johannes Jacobus c. 1350, and was then translated into Latin by Pansier (1909–1933). Though one can be reasonably certain of the accuracy of the last translation, the first two might leave much to be desired. The *Letters* appears to be a compilation by an unknown Arab(s) of the works Galen wrote on eye disease (Pansier, 1909–1933). Galen includes roses in numerous compounds; in a section on simple general remedies for the eyes, they are included in 5 out of 15 medicines. In case of eye injuries, he advises the sufferer to wash the eyes " patiently" in rose water and to dissolve the medicinal powders in rose water. Ground fresh roses are to treat scabies on the eyelids. In one of the rare exceptions to the rule that roses treat acute conditions, Galen recommends that the stomach be cleansed with rose honey as part of the cure for "hardness and albedo" of the eyes (Pansier, 1909–1933) (a reference to the cataract which results from chronic glaucoma?).

Walahfried's words indicate that rose medicines were highly respected in the Dark Ages (though, unless the wild growing *R. canina* was being used, they could not have been widespread): "No man can say / No man remember, how many uses there are / For Oil of Roses as a cure for mankind's ailments" (Payne, 1966).

The influential herbal of Apuleius Barbarus (also know as Pseudo-Apuleius and Apulei Platonici) written in 500 or 600 A.D. and of uncertain authorship despite the name given to it, listed many uses for a plant called "Rubus" with "cynos-

batos" given as a synonym. The accompanying illustration is not sufficiently clear to determine whether he meant a relative of the blackberry or *R. canina*. The number of uses listed in the copy I consulted (c. 1483) was unusual for a 7th century work and possibly some of them were interpolated later. "Rubus" was to be employed for ear pain, hemorrhoids, leucorrhea, heart trouble, recent wounds, inflammation of the gums and lips, and for condylomata; all of which, except the last, require the cooling and calming qualities attributed to the rose. For the same reason, perhaps, Apuleius recommends the plant for the bite of "serpent or man" (Apuleius, ca. 1483).

Avicenna, in the very early 11th century, repeated the dictum that roses are cooling and drying (Opitz, 1939).

Constantinus Africanus had a great impact on European medicine. He was an Arab from Carthage who settled in Italy. There, around 1050, he was the first to make medical texts in Arabic accessible to Europeans by translating them into Latin. In the process he usually endowed these works with his own name. Thus his *Liber de Oculis* seems to actually be a translation of a work by Honein (809–873), who compiled it from Galenic texts (Pansier, 1909–1933). In this work the rose is said to be cooling and to dissolve hardened substances. It is also "constrictive" and prohibits the flow of "humors," as occur literally in ophthalmia or eye injuries. For instance, for hordeolum (an inflammation of a sebaceous gland in the eyelid which feels much like a barleycorn) "bedeguar" mixed with ammonia dissolved in vinegar is applied. Rose powder or water or oil enter into several compounds for collyrium for sick eyes (Pansier, 1909–1933).

Macer Floridus from the late 1000s repeats the uses mentioned by Dioscorides, stressing that roses are especially good for the womb and for menorrhagia. He adds that the powder is good for mouth sours, as well as bleeding, and makes greater use of rose oil. Rose oil was drunk for uterine troubles, and rubbed on for headaches or itching. Held in the mouth, it alleviated toothache; and together with strong vinegar it was applied to wounds, burns or scalds. Constantinus Africanus is quoted as saying that the wild rose is hot and dry, while the garden rose (*R. centifolia*) is cold and dry in the first degree (Frisk, 1949).

Hildegard von Bingen, who lived at approximately the same time as Constantinus, recommends that roses be gathered at dawn and the petals then laid on the eyes to cure bloodshot eyes and make them clear. Belief in and use of the rose must have been spreading rapidly in the Germanic countries at this time, for she goes on to write that they are very good applied to ulcers and are a useful addition to "any medicine or salve" (Riethe, 1959). Fischer (1929) quotes her as saying that roses are also good for lung and liver pains, and that the fruits are good for stomach troubles.

Fischer (1929) has compiled a number of uses from early medieval Danish and German herbal glossaries and other texts. Taken all together, these works also follow Dioscorides, but they add the use of rose seeds for chest troubles and of rose leaves for lung troubles, they introduce the use of rose galls, and they record the use of the rose in cases of dizziness and neuralgia.

The *Circa Instans* was the standard pharmacological work from about 1200 until after the time of Paracelsus. It originated in Salerno, the medical capital of Europe at that time, but its actual authorship is unclear. It is usually attributed to a certain "Platearius," more for the sake of convenience than scholarly pre-

cision (Damm, 1938). In this work the rose is discussed under "anthera" whereas "bedegar" seems to refer to a *Crataegus* (hawthorn) species. The uses, once again, largely follow those given by Dioscorides, though the estimate of its hemostyptic power has increased somewhat. It is said that rose tea will still the flow of blood once a tooth has been pulled out (Damm, 1938). Rufinus, in his herbal written in the late 1200s, says repeatedly that his source is the *Circa Instans,* though it is possible that he was trying to give some of his own statements more authority by that means.

Rufinus includes all the classical applications of rose medicines and recommends their use to counteract heartburn and vomiting due to "choler." He specifies that rose buds and dry roses are used in medicine, while mature ones are useless. He also says that rose oil made in a glass vessel heated in a water bath "bonum est," but rose oil cooked directly above a flame is not given this epithet. Dry roses strengthen the brain and the heart and restore the spirit. After this, he quotes "Alexander" in making a distinction between red roses, which are more strengthening than astringent, and white roses, which are astringent rather than strengthening (Thorndike, 1946).

De Vegetabilibus (c. 1250) is indisputably authored by Albertus Magnus, in strong contrast to the *Book of Secrets* attributed to him. It is largely devoted to strictly botanical information, but he does report the properties of the more important medicinal plants. Referring to Avicenna and Dioscorides and someone abbreviated as Plemp., he lists the following properties for *R. canina* L.: for infants a preparation of the seeds stops diarrhea due to "corruptions" which affect the motion of the muscles; a soup made of the juice calms toothache; the root stops bloody sputum, stops diarrhea due to a debilitated stomach, and opens obstructions; the rose is especially binding in stomachics; it is good against long phlegmatic fevers; chewed and placed on scorpion bites it attracts the venom; drinking a preparation of the seed helps against all bites of reptiles, and "helps for many other things" (p. 359). Speaking of the rose generally, he states that it is opening and sedates the tenesmus of cholera; and he concludes by saying (p. 448), loosely translated, "altogether it comforts the interior organs and does many other things, as determined by the medical men."

The general popularity of the rose eventually pushed it into the class of a wonder drug. Joret (1892) records the uses recommended by a certain Hagendorn who said it was good even for epilepsy, tuberculosis, goiter and gout, as well as all the more usual illnesses.

The very important herbal *Hortus Sanitatis,* originally compiled by Jacob Meydenbach in 1491, devotes 4 pages to the rose, in contrast to the paragraph or so given to most plants. It refers to Avicenna, Rhazes, Dioscorides, Macer, and Joannes Mesue. As always, roses are mainly cool and dry. The white ones are said to be cooler, the red ones drier, on the authority of Mesue. Avicenna is quoted as believing that they "comfort the heart." Liver and stomach diseases, even cholera, are within the rose's field of activity. The *Hortus* notes that it has the ability to penetrate into the most dense and deep parts of the body, which constitutes a major factor in its ability to heal (Meydenbach, 1511).

During epidemics and plagues, rose fragrance or incense was held to purify the air. In public places one created one's own private cloud by carrying or wearing pomanders and perfumes. For the very rich there was better protection in the

form of goa stones. Precious stones were ground up with enough rose water to make a paste and form a pellet. Once dried, this was then carried on one's person (Gordon, 1953).

Roses did not escape from the application of the Doctrine of Signatures, even though they had no lack of obvious uses. Gordon (1953) gives the following quotation from Paracelsus: "Flowers that are of a burning color like the rose are apt to heal inflammations; those which bear the color of a face heated by wine, as the rose does, obviate drunkenness."

Later herbals demonstrate the influence of the major medieval classics. *An Herbal* of 1525 is an almost perfect transcription (except that it is in English) of part of Rufinus' section on roses. Turner, in 1548, says that they are cold and dry in the first degree. Gerard uses both rose water and crushed leaves gently heated with sugar for all that requires a gentle cooling, for eye pain, and to bring sleep (Woodward, 1964). Parkinson remarks that "the Rose is of exceeding great vse with vs." He differentiates among the uses of damask, red, and white roses, but taken together they still exemplify the medieval tradition (Parkinson, 1629).

A final, and seemingly fanciful, use of roses involved the payment of fines and rents with the flowers. However, when the landlord required a rose at Christmas and a snowball at Midsummer, this amounted to a tenancy terminable at will (Gordon, 1953). In 1379, one freshly picked rose per year was the fine levied for a minor building violation. To this day the Lord Mayor of London is presented with one red rose as the yearly installment on the original fine (Gordon, 1953). In a serious vein, the Bishop of Ely in England leased Ely Place in 1576 for 10 loads of hay, 20 bushels of roses, and 1 red rose to be paid yearly at Midsummer (Gordon, 1953).

LITERATURE CITED

Albertus Magnus (ca. 1250), E. Meyer, ed. 1867. De Vegetabilibus. Georg Reimer, Berlin.

Apuleius Barbarus (ca. 600) ca. 1483. Incipit Herbarium Apulei Platonici Joannes Philippus de Lignamine, Rome.

Best, M. R., and F. H. Brightman. 1973. The Book of Secrets of Albertus Magnus. Clarendon Press, Oxford.

Cornides, E. 1967. Rose und Schwert im Päpstlichen Zeremoniell. Verlag des Wissenschaftlichen Antiquariats H. Geyer, Wien.

Damm, W., ed. 1938. Circa Instans (de simplicibus [etc.]) [German version from the 1400s] by 'Platearius.' Ph.D. thesis, Friedrich-Wilhelms Univ., Berlin.

Darlington, C. D. 1963. Chromosome Botany and the Origins of Cultivated Plants. George Allen and Unwin, London.

Eastwick, E. B., trans. 1974. The Rose Garden of Shekh Muslihu'd—Din Sadi of Shiraz. Octagon Press, London.

Fischer, H. 1929. Mittelalterliche Pflanzenkunde. Münchner Drucke, München.

Frisk, G., ed. 1949. Macer Floridus, "De Viribus Herbarum," a Middle English translation. Almquist & Wiksells Boktryckeri AB, Uppsala.

Gordon, J. 1953. Pageant of the Rose. Studio Publications, New York, in association with Thomas Y. Crowell.

Guenther, E. 1952. The Essential Oils. Vol. 5. Van Nostrand, New York.

Gunther, R. T., trans. 1959. Greek Herbal of Dioscorides. Hafner, New York.

Hendrickson, R. 1974. Lewd Food. Chilton, Radnor, PA.

An Herbal (1525) 1941. S. V. Larkey and T. Pyles, eds. Facsimile of 1525 edition in the British Museum. New York Botanical Garden, New York. Scholars' Facsimiles and Reprints.

Hort, A., trans. 1916. Theophrastus (ca. 300 B.C.). Enquiry into Plants and Minor Works on Odours and Weather Signs. William Heinemann, London.
Joret, C. 1892. La Rose dans l'antiquité et au moyen âge. Emile Bouillon, Paris.
Krüssmann, G. 1977. The rose in art and history. Rose Annual p. 67–77.
———. 1980. Roses in the Middle Ages. Rose Annual p. 117–125.
Lehner, E., and J. Lehner. 1960. Folklore and Symbolism of Flowers, Plants and Trees. Tudor, New York.
Linsley, L. 1977. Rose petal beads. Garden 5: 24–25.
Meyer, E. 1855. Geschichte der Botanik. Gebruder Bornträger, Königsberg.
Meydenbach, J. (1491). Bernhardinus Benalius and Joannes Tacuinus de Cereto de Tridino, eds. 1511. Hortus Sanitatis, De Herbis et Plantis [etc.]. Venice.
Moldenke, H. N., and A. L. Moldenke. 1952. Plants of the Bible. Ronald, New York.
Mordmann, E. D., trans. 1845. Schech Ebu Ishak el Farsi el Isctachri [Sheik Abū Ishāk al-Fārisī el Istakrī] Das Buch der Länder. Rauhes Haus, Hamburg.
Opitz, K. 1939. Avicenna: das Lehrgedicht über die Heilkunde. Quellen Gesch. Naturwiss. Med. 7: 304–374.
Pansier, P., ed. 1909–1933. Constantini Monachi Monticassini, Liber de Oculis; [and] Galieni, Littiere ad Corisium, De Morbus Oculorum et eorum Curis. Librairie J. B. Baillière et Fils, Paris.
Parkinson, J. (1629) 1904. Paradisi in Sole, Paradisi Terrestris. Methuen, London. Reprint of 1629 ed.
Parry, E. J. 1925. Cyclopedia of Perfumery. Blakiston's Son, Philadelphia, PA.
Payne, R., trans. 1966. Walahfried Strabo, Hortulus. Hunt Botanical Library, Pittsburgh, PA.
Ranke, K. [1951]. Rosengarten: Recht und Totenkult. Hansischer Gildenverlag, Hamburg.
Riethe, P., ed. and trans. 1959. Hildegard von Bingen, Naturkunde. Otto Muller Verl., Salzburg.
Rimmel, E. 1865. The Book of Perfumes. Chapman & Hall, London.
Rowley, G. D. 1967. Chromosome studies and evolution in *Rosa*. Bull. Jard. Bot. Nat. Belg. 37: 45–52.
Sayers, D. L., and B. Reynolds, trans. 1964. The Comedy of Dante Alighieri; Cantica III; Paradise. Penguin Books, London.
de Slane, M. G., trans. 1862. Prolégomènes d'Ibn Khaldoun. Notices et Extraits des Manuscripts de la Bibliothèque Impérial. Tome 19. Paris.
Sutherland, R., ed. 1967. The Romaunt of the Rose and Le Roman de la Rose: a Parallel Text Edition. Basil Blackwell, Oxford.
Thompson, C. J. S. 1927. The Mystery and Lure of Perfumes. Lippincott, Philadelphia, PA.
Thorndike, L. 1946. The Herbal of Rufinus [late 1200s]. Univ. Chicago Press, Chicago.
Turner, W. (1548) 1965. The Names of Herbes. Facsimile of 1548 edition. Ray Society, London.
Woodward, M., ed. (1636) 1964. Gerard's Herball. Johnson edition of 1636. Spring Books, London.

Eesti Seente Koondnimestik (List of Estonian Fungi). L. Järva and E. Parmasto. Institute of Zoology and Botany, Academy of Sciences of the Estonian S.S.R., Tartu, 1980. 331 pp. 2 rubles 10 kopeks (soft cover).

For 15 years Drs. Järva and Parmasto and numerous of their colleagues collaborated in producing the first complete list of fungi (3,277 species) known to occur in Estonia. The record covers a 200-year period from 1777 to the present. The data appear in two parts: (1) a taxonomic section alphabetically records the genus and species of fungus, followed by references in the literature to its occurrence and to other pertinent data concerning it, and (2) a host index with appropriate literature citations. Introductory remarks are in Estonian, Russian, and English. The bibliography has 1,192 entries. This compendium should serve as an important guide for the phytopathologist who has a need for these significant data from the Estonian S.S.R.

B. Lowy, Louisiana State University, Baton Rouge, LA 70803